Con. 10997–12.   KR–1791

(4 Hours)   [Total Marks :100

N.B. :(1) Question No. **1** is **compulsory**.
    (2) Attempt any **four** questions out of remaining **six** questions.
    (3) Use of design data book such as PSG, Mahadevan etc. are **permitted**.
    (4) Assume **suitable** data if **required**.

1. (a) Derive Lewis equation for th beam strength of gear tooth.   5
   (b) Explain the desirable properties of the sliding contact bearing materials.   5
   (c) Explain static and dynamic seals.   5
   (d) Exlain the concept of bends in case of the wire ropes. What is its significance. 5

2. (a) A single row deep groove ball bearing No. 6403 is used to support the lay shaft 12
        of a four speed automabile gearbox. It is subjected to following loads.

Gear	Axial load (N)	Radial load (N)	Time engagged
I	3250	4000	1%
II	500	2750	3%
III	50	2700	21%
IV	0	0	75%

   The lay shaft is connected to the engine shaft and rotates at 1750 rpm. The
   bearing is expected to be in use for 4000 hours of operation. Find out the
   reliability with which the life could be expected.

   (b) Define static and dynamic load carrying capacity of rolling contact bearings.   8
        What are the advantages and disadvantages of rolling contact bearings as compared
        to sliding contact bearings.

3. (a) Design a worm and worm wheel drive for following specifications;   10
        Worm shaft speed — 800rpm
        Reduction ratio — 25
        Power to be transmitted — 12kW from an electric motor.
   Driven machine has medium shock and duty 12–14 hrs/day.
   Design should be based on strength and wear criteria.

   (b) A hydrodynamically lubricated full journal bearing supports a radial load of   10
        20kN when running at 1000 rpm. Assume bearing pressure of 1·6 N/mm^2 and
        minimum friction. Find Length and diameter of bearing, clearance ratio, minimum
        film thickness, viscosity of an oil, coefficient of friction, friction power loss and
        operating temperature of an oil.

[TURN OVER

4. A two stage helical & spyr gear box is used to transmit 10kW power from an electric   **20**
    motor running at 1440 rpm to a machine with overall reduction ratio of 20. Find the
    number of teeth for both stages and draw layout of gear box. Design the second stage
    gear pair based on the strength and wear. Check the gears for the dynamic load. Work
    out the constructional details of the pinion and the gear.

5. A rotary disc cam with central translatory roller follower has following motion;   **20**
        (i) Forward stroke of 30mm in 100° of cam rotation with parabolic motion
        (ii) Dwell for 40° of cam rotation
        (iii) Return storke of 30mm in 80° of cam rotation with cycloidal motion
        (iv) Remaining dwell to complete the cycle mass of the follower 1kg, cam shaft
            speed 600rpm. External force during forward stroke 500N and during return
            stroke 100N maximum pressure angle is limited to 25°.
            Design the cam and follower with pin and spring. Also calculate maximum
            torque on cam shaft.

6. A certrifugal pump directly coupled to a motor is requried to deliver 1000LPM of   **20**
    water against the total bead of 30m.
        (i) Select suitable motor
        (ii) Determine the diameter of suction and delivery pipes
        (iii) Design the impeller and impeller shaft
        (iv) Design the casing
        (v) Draw the layout.

7. The following specifications referes to an EOT Crane.   **20**
            Application ---------------- Class II
            Load to be lifted -------------- 100kN
            Hoisting Speed -------------- 6m/min
            Maximum lift ---------------- 10m
        (a) Select suitable type and size of wire rope for an expected life of 12 months.
        (b) Select standard book and check the induced stresses at the most critical
            sections. Design a nut for the book and select suitable bearing.
        (c) Design the pulley axle and select suitable bearings.
        (d) Design the cross piece and shackle plates.